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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|-------------------------|---------------------|------------------|
| 10/020,813 | 12/12/2001 | Srinivasan Chakravarthi | TI-33161 | 8922 |

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EXAMINER

HUYNH, YENNHU B

| ART UNIT | PAPER NUMBER |
|----------|--------------|
| 2813 | 5 |

DATE MAILED: 09/24/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | |
|------------------------------|----------------------------|---------------------|
| Office Action Summary | Application No. | Applicant(s) |
| | 10/020,813 | CHAKRAVARTHI ET AL. |
| | Examiner Yennhu B Huynh | Art Unit 2813 |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on 13 August 2002.

2a) This action is FINAL. 2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) Claim(s) 1-21 is/are pending in the application.

4a) Of the above claim(s) 8-21 is/are withdrawn from consideration.

5) Claim(s) _____ is/are allowed.

6) Claim(s) 1-7 is/are rejected.

7) Claim(s) _____ is/are objected to.

8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) The proposed drawing correction filed on _____ is: a) approved b) disapproved by the Examiner.
 If approved, corrected drawings are required in reply to this Office action.

12) The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
 a) The translation of the foreign language provisional application has been received.

15) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

| | |
|---|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ . |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2 . | 6) <input type="checkbox"/> Other: _____ . |

DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of claims 1-7 in Paper No. 4 is acknowledged.

Specification

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: Fabrication Of Abrupt Ultra Shallow Junctions With Fluorine Impurity Atom.

Claim Objections

Claim 4 is objected to because of the following informalities:

-line 3, the recite limitation --about 50nm of the surface-- should be changed to--about 50nm from the surface of the semiconductor substrate
Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lee (U.S. 5,773,337) in view of Lee (U.S. 6,037,640)

Re. claim 1:

Lee ('337) disclose:

-forming a coating comprising a dopant over a surface of the semiconductor substrate 1 (col.2, lines 43-65);

-heating the semiconductor substrate to cause a portion of the dopant to diffuse from the coating into the semiconductor substrate and thereby form a P-N junction within the semiconductor substrate (col.2, lines 5-24 and col. 3, lines 5-31);

-the semiconductor has an interstitial form (col.3, line 12) and at 1000 C degrees, the impurity atom is a faster diffusing species relative to silicon atoms (col.3, lines 32-45);

However, Lee ('337) does not disclose an impurity dosage of 1×10^{13} atoms/cm², and wherein the semiconductor substrate comprise a single crystal.

Lee ('640) disclose:

- the impurity ion has a dose of at least about 1×10^{13} atoms/cm² (col.7, lines 27-30); wherein the impurity atom is fluorine (col.3, lines 7-20).

-the semiconductor substrate comprises a single crystal (col.1, line 67).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine the Lee ('640)'s process in using an ion dosage of about 1×10^{13} atoms/cm² in doping to avoid short channel effects in forming the ultra shallow junctions, into Lee ('337)'s process.

Claims 2-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee (U.S. 5,773,337) in view of Lee (U.S. 6,037,640).

Lee ('337) disclose substantially all claimed invention includes:

-Re. claims 3&5: wherein the impurity atom is fluorine (col.1, lines 38-49), and wherein the dopant is boron (col.3, line 2);

-Re. claim 7: wherein the coating comprises a silicate (col. 3, lines 46-60);

However, Lee ('337) does not disclose the following features:

-Re. claim 2: prior to heating, the impurity ion has a dose of at least about 1×10^{14} atoms/cm² (col.7, lines 27-30);

-Re. claim 4: wherein after heating 90% of that portion of the dopant that has diffused into the semiconductor substrate is located within about 50nm of the surface (col.9&10, lines 60-19);

-Re. claim 6: after heating the concentration of the dopant within the substrate adjacent the surface is at least about 1×10^{18} atoms/cm² (col.9&10, lines 60-5)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to combine the Lee ('640) 's process in using an ion dosage of about 1×10^{14} atoms/cm² at prior heating to recombine interstitials vacancies, and about 1×10^{18} atoms/cm² at after heating to diffuse the dopant to form the ultra shallow junctions and , as well as 90% of that portion of the dopant that has diffused into the semiconductor substrate is located within about 50nm of the surface to obtain an abrupt change in the slope of the dopant profile at the shallow junctions, into Lee ('337) 's

process. This modification would complete the fabrication of abrupt ultra-shallow junctions.

Cited Prior Art

Maszara et al. (U.S. 6,362,063B1) in related art disclose formation of a shallow abrupt junction. The process include a mask, a single crystal substrate having an implanting an inert species into the substrate and a second dopant species and annealing the substraste to form an abrupt junction. This reference is deemed relevant to the current invention and should be careful reviewed before any amendment is filed.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yennhu B. Huynh whose telephone number is 703-308-6110. The examiner can normally be reached on M-F 8.30AM-7.00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached 703-306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

YNBH,

9/18/02

Application/Control Number: 10/020,813
Art Unit: 2813

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OLIK CHAUDHURI
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